US008585359B2

(12) **United States Patent**
Yu et al.

(10) **Patent No.: US 8,585,359 B2**
(45) **Date of Patent: Nov. 19, 2013**

(54) **HEAT DISSIPATION DEVICE AND CENTRIFUGAL FAN THEREOF**

(75) Inventors: **Fang-Xiang Yu**, Shenzhen (CN); **Xian-Min Jin**, Shenzhen (CN); **Jer-Haur Kuo**, Taipei Hsien (TW)

(73) Assignees: **Fu Zhun Precision Industry (Shen Zhen) Co., Ltd.**, Shenzhen (CN); **Foxconn Technology Co., Ltd.**, New Taipei (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 840 days.

(21) Appl. No.: **12/770,783**

(22) Filed: **Apr. 30, 2010**

(65) **Prior Publication Data**

US 2011/0247789 A1 Oct. 13, 2011

(30) **Foreign Application Priority Data**

Apr. 7, 2010 (CN) 2010 1 0140938

(51) **Int. Cl.**
F04D 29/44 (2006.01)

(52) **U.S. Cl.**
USPC **415/177**; 415/211.2

(58) **Field of Classification Search**
USPC 415/177, 182.1, 208.1, 208.2, 208.3, 415/208.4, 211.1, 211.2, 224, 206; 361/695, 696
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2006/0081367 A1* 4/2006 Chiu et al. 165/296
2008/0011461 A1* 1/2008 Hwang et al. 165/122
2008/0093056 A1* 4/2008 Hwang et al. 165/104.33

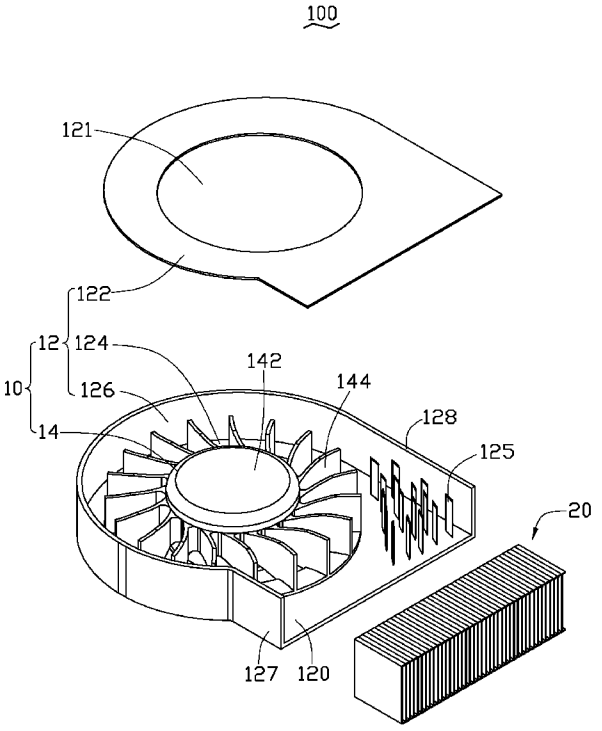
* cited by examiner

Primary Examiner — Edward Look
Assistant Examiner — Maxime Adjagbe
(74) *Attorney, Agent, or Firm* — Altis & Wispro Law Group, Inc.

(57) **ABSTRACT**

A centrifugal fan includes a casing and an impeller received in the casing. The casing defines an air outlet at one side thereof. An air channel is defined in the casing between a sidewall of the casing and outermost free ends of blades of the impeller. The air channel has an upstream end and a downstream end along a rotation direction of the impeller. A plurality of air guide plates is formed in the casing and disposed at a junction between the downstream end of the air channel and an area of the air outlet directly communicating with the downstream end of the air channel. The air guide plates are structured and arranged in a streamlined manner and pattern with respect to air flowing from the downstream end of the air channel towards the air outlet.

2 Claims, 4 Drawing Sheets



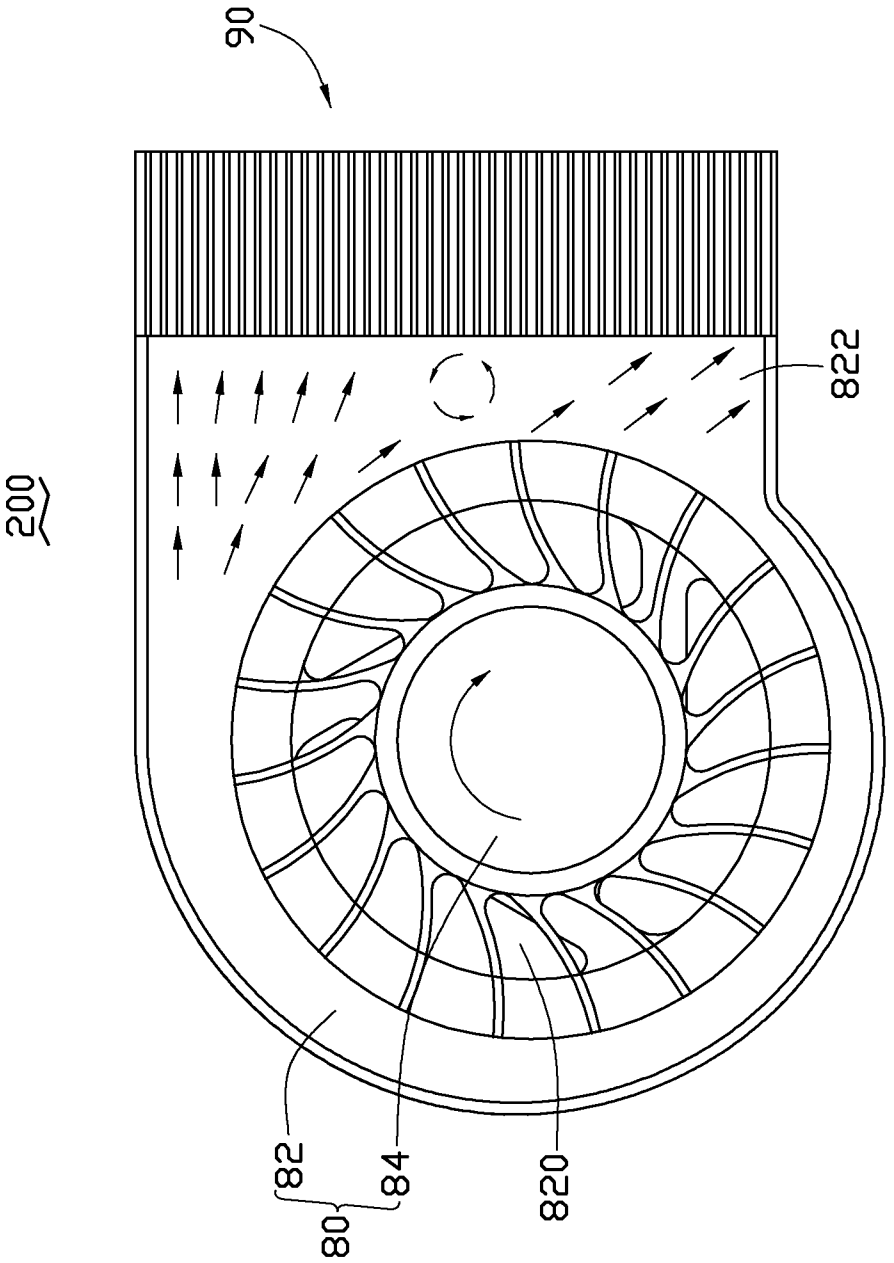


FIG. 1
(RELATED ART)

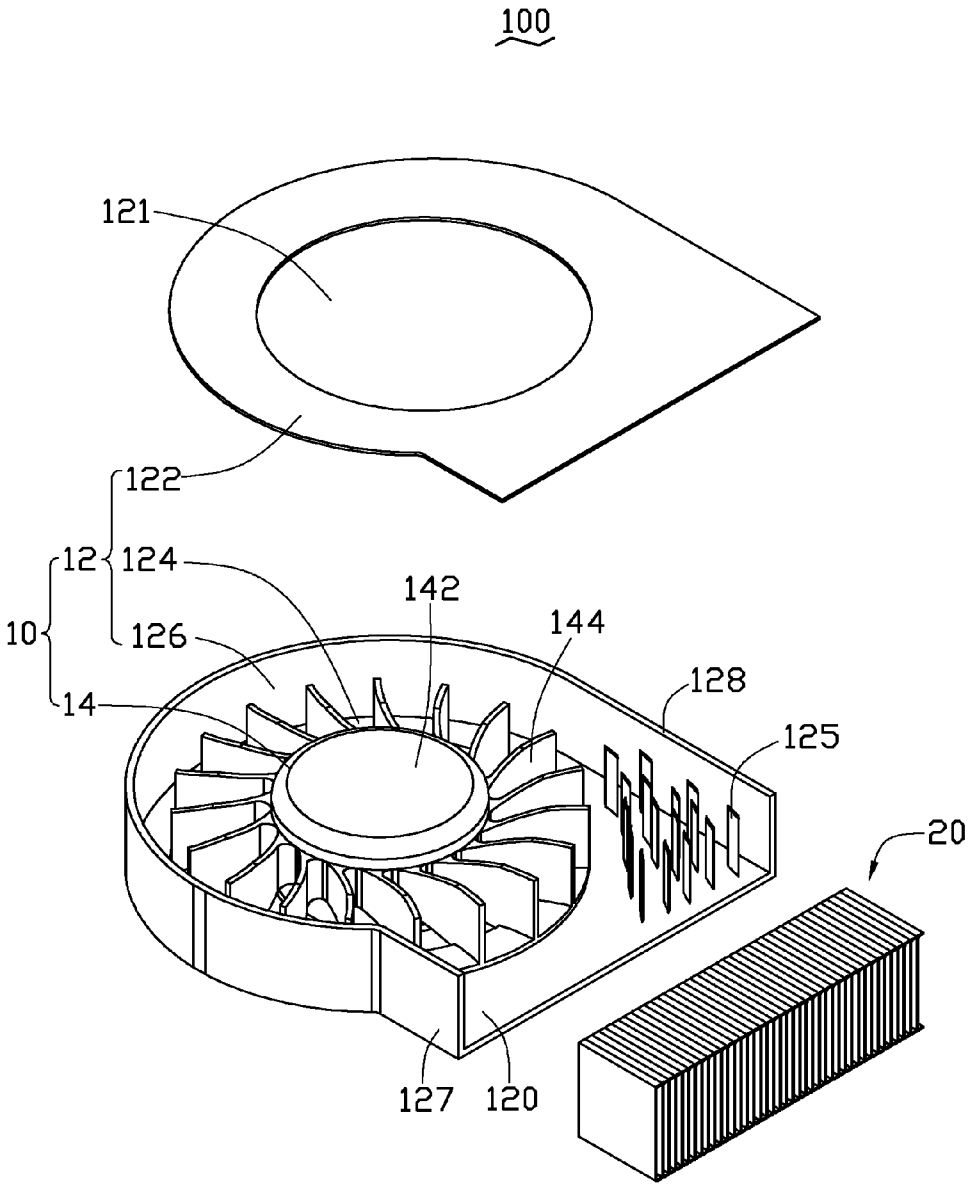


FIG. 2

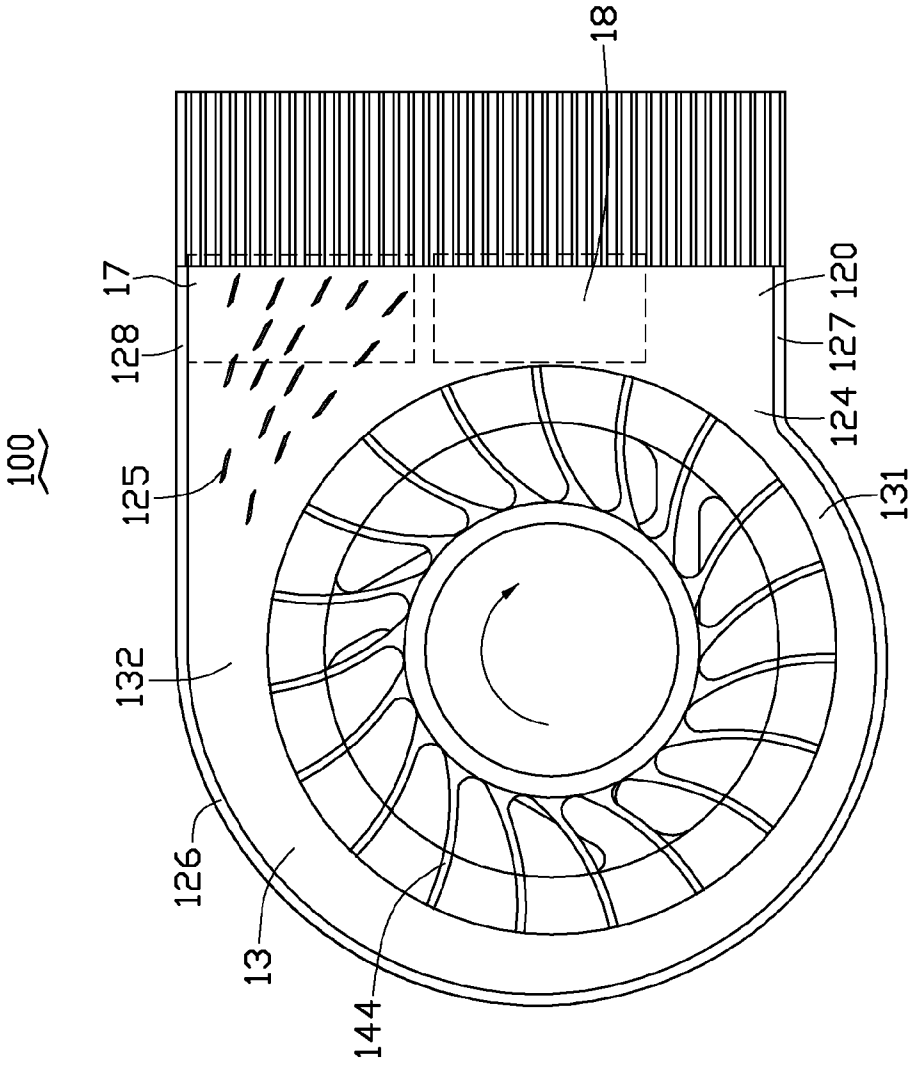


FIG. 3

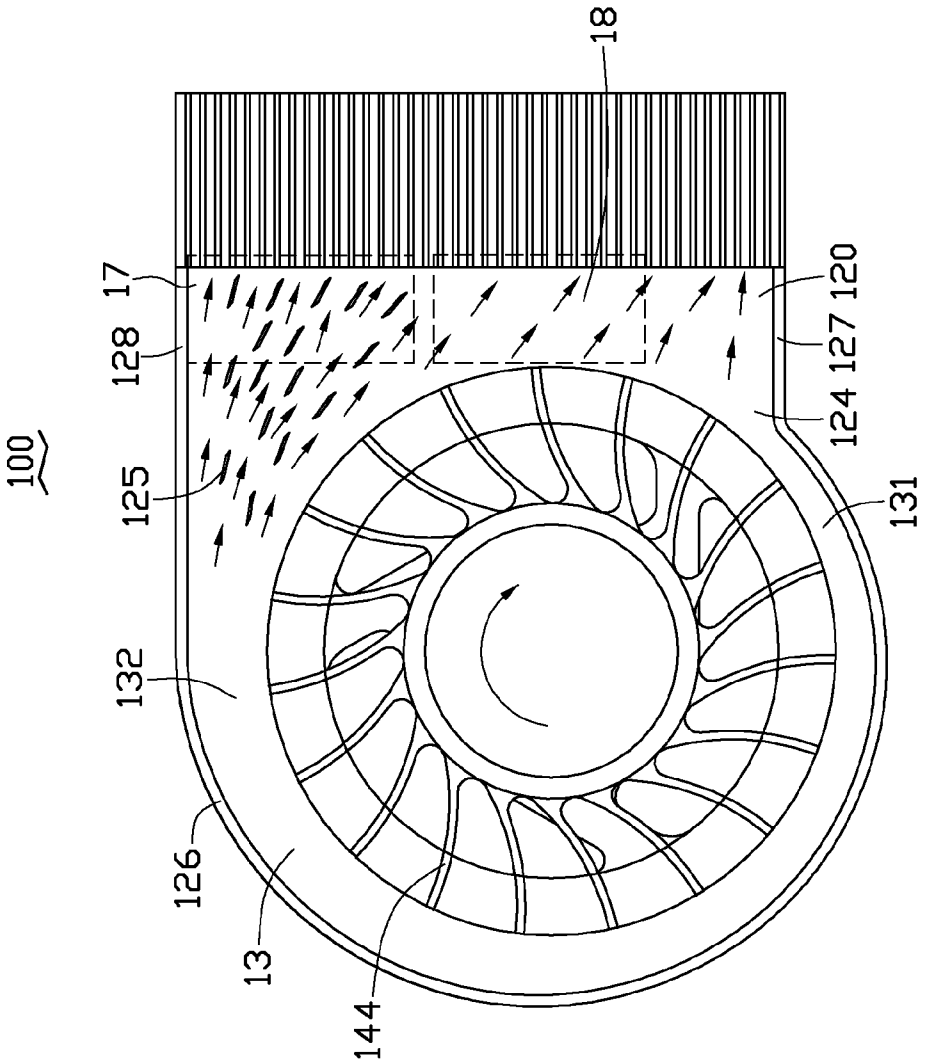


FIG. 4

HEAT DISSIPATION DEVICE AND CENTRIFUGAL FAN THEREOF

BACKGROUND

1. Technical Field

The present disclosure relates to heat dissipation devices, and particularly to a heat dissipation device incorporating a centrifugal fan.

2. Description of Related Art

Heat dissipation devices are often applied to dissipate heat from heat generating components, such as central procession units (CPUs). FIG. **1** shows a conventional heat dissipation device **200**. The heat dissipation device **200** includes a fin assembly **90** thermally connected with a heat generating component (not shown), and a blower **80**. The blower **80** includes a housing **82**, and an impeller **84** received in the housing **82**. The blower **80** defines an air outlet **822** at one side thereof. The fin assembly **90** is located at the air outlet **822** of the blower **80**.

During operation of the heat dissipation device **200**, the fin assembly **90** absorbs heat from the heat generating component and dissipates the heat to the ambient environment. The impeller **84** of the blower **80** rotates clockwise and drives air to the fin assembly **90** to evacuate heat from the fin assembly **90**. However, as shown in FIG. **1**, a large quantity of air flows to a right-hand side of the air outlet **822**, whereas less air flows to an opposite left-hand side of the air outlet **822**, and even less air flows to a center of the air outlet **822**. Thus, the blower **80** does not fully optimize cooling of a portion of the fin assembly **90** located at the center of the air outlet **822**. In addition, uneven distribution of the airflow at the air outlet **822** can generate a plurality of vortexes at the center of the air outlet **822**.

Thus, it is desired to overcome the described limitations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view of a blower of a frequently used heat dissipation device, but not showing a cover thereof, and showing airflow paths inside the blower.

FIG. **2** is an exploded, isometric view of a heat dissipation device in accordance with an exemplary embodiment, the heat dissipation device including a cover.

FIG. **3** is an assembled top plan view of the heat dissipation device of FIG. **2**, with the cover removed.

FIG. **4** is similar to FIG. **3**, but showing airflow paths inside the heat dissipation device.

DETAILED DESCRIPTION

FIGS. **2** and **3** show a heat dissipation device **100** in accordance with an exemplary embodiment. The heat dissipation device **100** includes a centrifugal fan **10**, and a fin assembly **20** adjacent to the centrifugal fan **10**. The fin assembly **20** includes a plurality of fins (not labeled) stacked together. The centrifugal fan **10** includes a casing **12**, and an impeller **14** received in the casing **12**. The impeller **14** includes a hub **142**, and a plurality of blades **144** extending radially and outwardly from an outer periphery of the hub **142**. The casing **12** includes a top cover **122**, a bottom plate **124**, and a sidewall **126** connecting the top cover **122** with the bottom plate **124**. The top cover **122**, the bottom plate **124** and the sidewall **126** cooperatively define a receiving space (not labeled) therein for receiving the impeller **14**.

The top cover **122** defines an air inlet **121** at a center thereof. The impeller **14** is mounted to the bottom plate **124** and aligned with the air inlet **121** of the top cover **122**. The sidewall **126** extends perpendicular to a circumference of the bottom plate **124**, and an air outlet **120** is defined between two ends of the sidewall **126**. The impeller **14** is spaced from the sidewall **126**, with an air channel **13** defined between the sidewall **126** and outermost free ends of the blades **144** of the impeller **14**. A width of the air channel **13** gradually increases along a rotation direction of the impeller **14**, such that the air channel **13** defines a narrow portion **131** at an upstream end of the air channel **13** and a wide portion **132** at a downstream end of the air channel **13**.

The sidewall **126** includes a first plate **127**, and a second plate **128** facing and parallel to the first plate **127**. The first plate **127** and the second plate **128** are spaced from each other and located at opposite sides of the air outlet **120**, with the air outlet **120** defined therebetween. The first plate **127** is located adjacent to the narrow portion **131** of the air channel **13**, while the second plate **128** is located adjacent to the wide portion **132** of the air channel **13**. The air outlet **120** defines a first area **17** near the second plate **128** of the sidewall **126**, and a second area **18** at a central portion of the air outlet **120**. The first area **17** is located at a right-hand side of the air outlet **120**, and communicates with the wide portion **132** of the air channel **13**. The first area **17** is located between the second area **18** and the second plate **128** of the sidewall **126**.

The bottom plate **124** of the casing **12** forms a plurality of slim air guide plates **125** at the wide portion **132** of the air channel **13** near the air outlet **120** and at the first area **17** of the air outlet **120**. The air guide plates **125** are integrally formed with and extend upwardly from the bottom plate **124**. That is, the air guide plates **125** and the bottom plate **124** are portions of a single, one-piece, monolithic body of the one same material. Alternatively, the air guide plates **125** can be fixed on the bottom plate **124** after the bottom plate **124** and the air guide plates **125** have been separately formed.

Each air guide plate **125** is rectangular and includes an inner end and an opposite outer end. The outer end is located closer to the air outlet **120** than the inner end. The outer end is farther from the second plate **128** than the inner end. Thus, the air guide plates **125** are obliquely angled with respect to the second plate **128** of the sidewall **126**. An angle with respect to the second plate **128** of the air guide plates **125** nearer the second plate **128** is less than that of the air guide plates **125** distant from the second plate **128**.

The air guide plates **125** are arranged in a generally streamlined pattern from the wide portion **132** of the air channel **13** towards the first area **17** of the air outlet **120**. The air guide plates **125** are arranged with air passages defined between each two neighboring lines of one or more air guide plates **125**. The number of air guide plates **125** increases from the wide portion **132** of the air channel **13** to the air outlet **120**, and an area occupied by the air guide plates **125** gradually increases from the wide portion **132** of the air channel **13** to the air outlet **120**. Thus a portion of the air guide plates **125** nearest to the second area **18** of the air outlet **120** is those air guide plates **125** in a portion of the first area **17** of the air outlet **120** that is nearest to the second area **18**. Put another way, said portion of the air guide plates **125** can be considered to be arranged to generally extend towards the second area **18** of the air outlet **120**.

Referring also to FIG. **4**, during operation of the centrifugal fan **10**, the impeller **14** rotates and drives air from the air inlet **121** into the air channel **13** of the casing **12**. The air flows from the narrow portion **131** to the wide portion **132** of the air channel **13**, and then to the air outlet **120**. Since the air initially flows from the air channel **13** to the first area **17** of the air outlet **120**, the airflow at the first area **17** is highest. In

contrast, the airflow to and at the second area **18** is less, because the air pressure decreases sharply after the air leaves the air channel **13**.

Due to the presence of the air guide plates **125**, a portion of the airflow heading to the first area **17** is guided by the air guide plates **125** towards the second area **18**, where airflow is increased accordingly. As a result, the heat dissipation efficiency of the fins of the fin assembly **20** located at the second area **18** is improved. In addition, the air guide plates **125** are structured and arranged in a streamlined manner and pattern, which can minimize or avoid airflow resistance through the air guide plates **125**.

It is to be understood, however, that even though numerous characteristics and advantages of the exemplary embodiments have been set forth in the foregoing description, together with details of the structures and functions of the embodiments, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A heat dissipation device, comprising:

a centrifugal fan comprising a casing and an impeller received in the casing, the casing comprising a top cover, a bottom plate, and a sidewall connecting the top cover with the bottom plate, and the casing defining an air outlet at one side thereof between the top cover and the bottom plate; and

a fin assembly located adjacent to the air outlet of the centrifugal fan, a bottom end of the fin assembly being coplanar with a bottom surface of the bottom plate;

wherein an air channel is defined in the casing between a sidewall of the casing and outermost free ends of blades of the impeller, the air channel comprising an upstream end and a downstream end along a rotation direction of the impeller, a plurality of air guide plates formed in the casing and disposed at a junction between the downstream end of the air channel and an area of the air outlet directly communicating with the downstream end of the air channel, the air guide plates structured and arranged in a streamlined manner and pattern with respect to air flowing from the downstream end of the air channel towards the air outlet and guiding one or more portions of such flowing air generally toward another area of the air outlet not directly communicating with the downstream end of the air channel;

wherein the air channel defines a narrow portion at the upstream end of the air channel and a wide portion at the downstream end of the air channel, the air outlet defines a first area near the wide portion of the air channel and a second area at a central portion of the air outlet, and the air guide plates are located at the wide portion of the air channel near the air outlet and at the first area of the air outlet, the number of air guide plates increases from the wide portion of the air channel to the air outlet, and an area occupied by the air guide plates gradually increases from the wide portion of the air channel to the air outlet.

2. The heat dissipation device of claim **1**, wherein each of a plurality of the air guide plates more distant from the second plate guides one or more portions of said one or more portions of such flowing air generally towards the second area of the air outlet.

* * * * *